

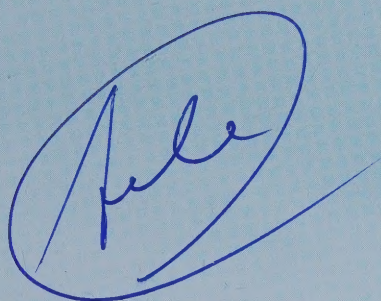
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FATHOM

OCEANOLOGY LIMITED

Annual Report 1976

FOR THE YEAR ENDED MARCH 31, 1976



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The Outlook

The prospects for the continuing growth of the ocean industry in general and Fathom Oceanology Limited in particular continue to be encouraging. Fathom came into being at a time when the commercial aspects of the ocean industry were small and limited to continental shelf operation. As the industry moves increasingly into mid-ocean operations, such as manganese nodule mining, the challenges and opportunities increase. Fathom has identified the deep-sea opportunity and has concentrated its development of new products largely in this area.

With its basic product line for both military and commercial applications well established internationally the Company is now concentrating on the development of new products and new markets. It faces the future with growing confidence.

Staff

The number of people employed by the Company at the end of the financial year was 45. This is 13 more than a year earlier. The increased volume of activity has necessitated additional help, much of which is highly technical and specialized. The Company has been fortunate in attracting some very capable people to its team and collectively the staff has an expertise in a precise area of oceanology that makes it literally unique in the world.

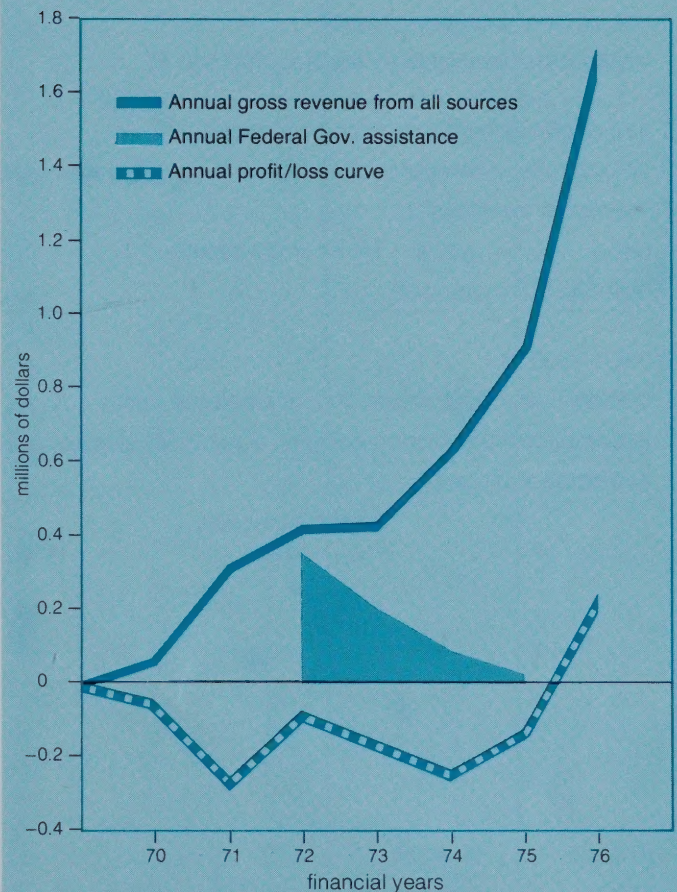
The Company is its people and to those of Fathom Oceanology, the Directors express their respect and thanks.

By Order of the Board of Directors.

K. R. Olsen

K. R. Olsen,
President.

FINANCIAL HISTORY



The figure shows the Company's progress since inception in 1968. Between 1969 and 1972, gross revenue was unstable and was more than offset by the high costs of international marketing and the need for experienced designers and engineers employed on development. This resulted in the early losses. In 1972, the Federal Government came to our aid to share development costs and this action saved the Company from foundering. 1975 saw the beginning of turn-around as gross revenue accelerated sufficiently to permit us to continue with reduced and finally no aid from Government sources. Fiscal 76 proved our fundamental viability. The market is there in sufficient volume to return a reasonable margin of profit while maintaining the sophisticated marketing, engineering and manufacturing staff and facilities that are vital to the high technology and inflationary environment in which the Company operates.

Directors

- †*K. R. OLSEN, Hudson, Quebec.
President, Fathom Oceanology Limited,
Vice President, Atlas Construction Limited,
President, G. M. Gest Ltd. & Subsidiaries.
- *R. L. I. FJARLIE, Maxville, Ontario.
Executive Vice President, Fathom Oceanology Limited.
- *N. E. HALE, Mississauga, Ontario.
Vice President Engineering, Fathom Oceanology Limited.
- †*J. B. FOOTE, Cambellcroft, Ontario.
Business Consultant.
- K. GARDNER, Mississauga, Ontario.
Vice President Export Development, Fathom Oceanology Limited.
- †J. E. NORDIN, Montreal, Quebec.
General Manager, Corporate Development, Federal Business
Development Bank.
- F. D. SHAW, Etobicoke, Ontario.
President, Pemtech Inc.
- * Member of the Executive Committee
† Member of the Audit Committee

Officers

K. R. OLSEN, President
R. L. I. FJARLIE, Executive Vice President
N. E. HALE, Vice President
K. GARDNER, Vice President
J. O. EMPEY, Vice President
D. W. FAIRLES, Treasurer and Financial Controller
R. A. DONALDSON, Secretary

Head Office and Plant

863 Rangeview Road, Port Credit, Ontario.

Subsidiary Company

Hale & Associates Limited, Port Credit, Ontario.

Transfer Agent and Registrar

National Trust Company Limited, Toronto, Ontario and Calgary, Alberta.

Banker

Bank of Montreal, Toronto, Ontario.

Auditors

Clarkson, Gordon & Co., Toronto, Ontario.

Legal Counsel

Blake, Cassels & Graydon, Toronto, Ontario.

The annual meeting of the shareholders of
Fathom Oceanology Limited will be held
in the Library Room of the Royal York
Hotel, Toronto at 4 P.M. on the
31st day of August 1976.

FATHOM OCEANOLOGY LIMITED

(Incorporated under the laws of Canada)

To the Shareholders of
Fathom Oceanology Limited

Summary

Net income for the year ended March 31, 1976 amounted to \$220,200 or 15¢ per share, including an extraordinary item arising from the reduction in income taxes due to losses carried forward of \$92,700 or 6¢ per share. This compares with a loss of \$130,000, or 9¢ per share reported for the previous year. Revenue increased by 83% over the \$931,000 reported last year to \$1,702,600.

The year was the most successful in the Company's history. Since incorporation in December, 1968 a number of dedicated people, many of whom have been with the Company since the early days, have fought to bring to market a unique high technology product. After several loss years, profitability has been realized. This position is the result of improved operating efficiencies and a level of business activity broad enough to more than balance fixed expenses.

There is sufficient evidence to expect a continuation of profitability, subject to unexpected changes in the economic climate.

Completed Contracts and Work in Progress

Contracts completed during the year covered the full range of the Company's products and included towing systems, winches, cable fairings, towed fish, sonar domes and component parts.

A large percentage of the sales were for export to numerous countries including the United States, Germany, Holland, Australia, Sweden, Spain, Brazil, Italy, the United Kingdom and Japan, through various companies or organizations that form the core of the Company's clientele.

Of the work in progress the \$1.3 million project for a customer in Germany is the largest. It calls for an ultra deep-sea towing system that will be used for manganese nodule exploration. Of equal significance is an ongoing order for sonar domes that the shop is producing at the rate of about one a month.

The value of uncompleted work on hand at the end of the financial year was \$1,084,000 or more than twice the amount of a year ago.

The Development of New Products

While the heart of the Company's present business activity is the design and manufacture of towed fish, faired cable, launching and recovery gear and sonar domes, the development of other products remains an important undertaking.

The Company has become well known and respected throughout the oceanology world community and is being invited to contribute its expertise in many areas where current problems exist. The potential opportunities for future business in new products are good and a review of this subject will be found elsewhere in this report.

Financial Affairs

The profit earned this year has eliminated last year's net shareholders' deficit of \$194,861 and has also produced a margin of working capital. Intensive marketing, more sophisticated cost structuring based on growing experience and the 83% increase in gross revenue are the main ingredients of the turnaround position. Overall efficiencies have improved and this is reflected in the fact that administrative costs including interest have increased by only 29% over the previous year while supporting this sizeable increase in revenue.

The last annual report showed, with some satisfaction, that financial assistance from the Canadian Government had declined from a high in 1972 of \$350,000 to less than \$9,000 in 1975. This year a PAIT grant has re-appeared in the report. This has come about as a result of the Canadian and West German Governments agreeing to a joint sharing of the development costs incurred by the Company on the large order for deep-sea towing gear described above. PAIT (Program for Advancement of Industrial Technology) was chosen by the Canadian Government as its vehicle for forwarding the funds to Fathom and, as such, it does not represent government assistance to Fathom as we used to know it, but rather an integral part of the contract revenue being earned on this project.

FATHOM OCEANOLOGY LIMITED

(Incorporated under the laws of Canada)

Consolidated Balance Sheet at March 31, 1976 (with comparative figures at March 31, 1975)

Assets

CURRENT ASSETS:

	1976	1975
Cash and short term deposit	\$ 167,226	
Accounts receivable (notes 3(a), 3(c) and 5)	483,598	\$181,269
Costs and estimated earnings in excess of billings on uncompleted contracts	145,840	132,170
Inventory, at lower of cost and net realizable value	44,541	27,037
Prepaid expenses	2,583	3,054
Total current assets	<u>843,788</u>	<u>343,530</u>

FIXED ASSETS (note 2)	<u>157,547</u>	<u>112,272</u>
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OTHER ASSETS:

Patents and patents pending, at amortized cost	67,550	79,589
Completed engineering designs, at nominal value	1	1
Rent deposits	<u>10,213</u>	<u>10,213</u>
Total other assets	<u>77,764</u>	<u>89,803</u>

<u>\$1,079,099</u>	<u>\$545,605</u>
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On behalf of the Board:

K. R. OLSEN, Director

R. L. I. FJARLIE, Director

(See accompanying notes)

Liabilities and Shareholders' Equity

CURRENT LIABILITIES:

	1976	1975
Bank indebtedness (note 3(c))	\$ 7,750	\$ 90,957
Accounts payable and accrued charges	279,783	158,539
Billings in excess of costs and estimated earnings on uncompleted contracts	378,170	64,847
Due to Ontario Development Corporation — export support loan (note 3(a))	113,576	150,000
Employee income and other taxes payable	16,187	9,597
Current portion of venture capital loan	8,956	8,280
Total current liabilities	<u>804,422</u>	<u>482,220</u>

NON-CURRENT LIABILITIES:

12% convertible notes payable (note 3(b))	184,050	184,050
Due to Ontario Development Corporation — venture capital loan (note 3(a))	65,240	74,196
Total non-current liabilities	<u>249,290</u>	<u>258,246</u>

SHAREHOLDERS' EQUITY:

Share capital (notes 3(b) and 4) —		
Authorized:		
3,000,000 common shares		
without nominal or par value		
Issued:		
1,478,667 common shares	690,818	690,818
Deficit (statement 2)	(665,431)	(885,679)
	<u>25,387</u>	<u>(194,861)</u>
	<u>\$1,079,099</u>	<u>\$545,605</u>

Auditors' Report

To the Shareholders of
FATHOM OCEANOLOGY LIMITED

We have examined the consolidated balance sheet of Fathom Oceanology Limited and its subsidiary as at March 31, 1976 and the consolidated statements of income and deficit and changes in financial position for the year then ended. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion these consolidated financial statements present fairly the financial

position of the companies as at March 31, 1976 and the results of their operations and the changes in their financial position for the year then ended, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Toronto, Canada
June 9, 1976

CLARKSON, GORDON & CO.
Chartered Accountants

FATHOM OCEANOLOGY LIMITED

(Incorporated under the laws of Canada)

Consolidated Statement of Income and Deficit

for the year ended March 31, 1976
(with comparative figures for 1975)

(Statement 2)

	1976	1975
CONTRACT REVENUE (note 5)	\$1,702,626	\$ 918,977
COSTS:		
Manufacturing	1,128,254	777,070
Administrative	309,950	226,663
Product design		6,164
Interest — long term debt	28,711	28,916
— short term debt	15,463	19,128
	1,482,378	1,057,941
Less recovery of costs by grants from Government of Canada		(8,893)
Net costs	1,482,378	1,049,048
Income (loss) before income taxes and extraordinary item	220,248	(130,071)
Income taxes	92,700	
Income (loss) before extraordinary item	127,548	(130,071)
Extraordinary item — reduction in income taxes arising from losses carried forward (note 8)	92,700	
Net income (loss) for the year	220,248	(130,071)
Deficit, beginning of year	(885,679)	(755,608)
Deficit, end of year	\$ (665,431)	\$ (885,679)
Income (loss) per share:		
Before extraordinary item	\$0.09	\$(0.09)
For the year	\$0.15	\$(0.09)
Fully diluted income (loss) per share:		
Before extraordinary item	\$0.07	\$(0.09)
For the year	\$0.12	\$(0.09)

1st profitable
continuous profit

(See accompanying notes)

FATHOM OCEANOLOGY LIMITED

(Incorporated under the laws of Canada)

Consolidated Statement of Changes in Financial Position for the year ended March 31, 1976 (with comparative figures for 1975)

(Statement 3)

FUNDS WERE RECEIVED FROM:

Operations —

Income (loss) before extraordinary item	\$127,548	\$(130,071)
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Add charges not requiring an outlay of working capital:

Depreciation and amortization of fixed assets	59,992	42,245
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Amortization of patents and patents pending	17,135	13,561
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Funds received from (applied to) operations	204,675	(74,265)
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Extraordinary item	92,700	
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Issue of common shares		178,196
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Total funds received	297,375	103,931
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FUNDS WERE APPLIED TO:

Purchase fixed assets	105,267	37,841
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Cost of patents and patents pending	5,096	3,849
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Reduce long term debt	8,956	8,280
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Total funds applied	119,319	49,970
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Increase in working capital during the year	\$ 178,056	\$ 53,961
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Changes in components of working capital:

Increase (decrease) in current assets—

Cash and short term deposit	\$ 167,226	
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Accounts receivable	302,329	\$ (14,110)
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Inventory	17,504	(14,398)
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Other	(471)	(2,267)
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	486,588	(30,775)
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(Increase) decrease in current liabilities —

Bank indebtedness	83,207	65,758
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Uncompleted contracts (net)	(299,653)	13,031
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Amounts payable	(127,834)	5,064
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Ontario Development Corporation	35,748	883
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	(308,532)	84,736
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Increase in working capital during the year	178,056	53,961
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WORKING CAPITAL DEFICIENCY, beginning of year	(138,690)	(192,651)
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WORKING CAPITAL (DEFICIENCY), end of year	\$ 39,366	\$(138,690)
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(See accompanying notes)

FATHOM OCEANOLOGY LIMITED

(Incorporated under the laws of Canada)

Notes to Consolidated Financial Statements March 31, 1976

1. Accounting policies

The following is a summary of certain significant accounting policies followed in the preparation of the consolidated financial statements. The policies conform to generally accepted accounting principles and have been applied consistently.

(a) Basis of consolidation —

The consolidated financial statements include the accounts of the company's wholly-owned subsidiary, Hale & Associates Limited.

(b) Contracts —

Profits on contracts are recorded using the percentage of completion method. Complete provision is made for losses on contracts in progress when they first become known. In the case of contracts extending over one or more years, revisions in cost and profit estimates, which can be significant, are reflected in the accounting period in which the relevant facts become known.

When the company enters into contracts with customers to develop and produce specialized equipment with the expectation that the Canadian government will share the specific development costs with the customer, the related government grants are accounted for as revenue by the company.

(c) Fixed assets —

Fixed assets are recorded at acquisition cost. Where government grants are received specifically for a particular fixed asset, the cost of that asset is reduced by the amount of the government grant. Depreciation is recorded in the accounts on the declining balance basis at the following rates:

Equipment and ship ocean simulator	20%
Patterns and tooling	33 1/3%

Leasehold improvements are amortized according to the straight line method over the term of the lease. Costs which extend the useful life of a fixed asset are capitalized. All other costs of repairs and maintenance are charged to operations as incurred.

(d) Research and development —

Research and development costs, excluding costs of patents and patents pending, are charged to operations as incurred. Where government grants are received for research and development projects initiated by the company for its own purposes, these grants are deducted from the research and development costs.

(e) Patents and patents pending —

The costs incurred for patents and patents pending are capitalized. The costs incurred to March 31, 1971 are being amortized over the projected sales to March 31, 1978. Costs subsequent to March 31, 1971 are being amortized on a straight line basis over a ten year period.

(f) Engineering designs —

Costs of engineering designs are charged to operations as incurred.

2. Fixed assets

	Original cost	Government grant (note 7)	Accumulated depreciation and amortization	Net book value	
				1976	1975
Equipment	\$117,636	—	\$ 57,421	\$ 60,215	\$ 23,221
Ship ocean simulator	95,798	\$41,633	30,917	23,248	27,595
Leasehold improvements	28,925	—	17,089	11,836	12,037
Patterns and tooling	229,519	34,622	132,649	62,248	49,419
Total fixed assets	<u>\$471,878</u>	<u>\$76,255</u>	<u>\$238,076</u>	<u>\$157,547</u>	<u>\$112,272</u>

Reference is made to note 3(a).

3. Loans and notes payable

(a) The Ontario Development Corporation (O.D.C.) —

In 1973, the company entered into an agreement with O.D.C. under which O.D.C. agreed to advance an 8% venture capital loan of \$100,000 and a 6 1/2% export support loan of up to \$150,000. During the 1976 year, the company obtained approval from O.D.C. of an increase in the maximum level of the export support loan from \$150,000 to \$500,000. The venture capital loan is being repaid over ten years in blended monthly payments of principal and interest of \$1,206. The export support loan is available to provide funds upon receipt of a contract to finance the manufacture and sale of equipment for export. Of the \$500,000 available, a maximum of \$150,000 can be used to finance the manufacturing stage of export orders and the remainder can be used to finance related receivables. Loans are repayable out of amounts received from the relevant contracts, or on demand.

The loans are secured by:

- chattel mortgage on equipment owned by the company, except for certain equipment described in note 3(c);
- a floating charge on all assets (except accounts receivable required to secure any bank loans — reference is made to note 3(c));
- an assignment and postponement for ten years of 12% convertible notes outstanding as described in note 3(b);
- an assignment of fire and export insurance policies;
- an assignment of specific accounts receivable related to sales financed under the export support loan program.

(b) 12% convertible notes —

Under the terms of an agreement signed by the noteholders in favour of O.D.C., the 12% convertible notes cannot be redeemed until all loans from O.D.C. have been repaid. Reference is made to note 3(a).

Pursuant to the terms of a resolution passed by the shareholders on August 27, 1975, the notes are convertible at the option of the noteholder at the rate of 1 share for every \$0.50 of notes until August 27, 1978. Thereafter, the rate increases to \$0.60. The company has reserved 368,100 unissued shares for the possible conversion of these notes.

(c) Bank indebtedness —

The bank loan is secured by a general assignment of those book debts and inventories not assigned to the Ontario Development Corporation, as well as a chattel mortgage on specific equipment. Reference is made to note 3(a).

4. Employee share option and share purchase plans

During the year, the share option plan was terminated as all options which had been granted under this plan had expired without being exercised. In October 1975 the company adopted new employee share option and share purchase plans, whereby the company may grant to certain employees the right to purchase the company's shares at 90% of the market price on the day before the directors' meeting at which the right is granted. The employees may choose either plan or a combination of plans, and, with the exception of option holders under the former plan, acquire their right to purchase shares at the rate of 20% cumulatively over a five year period by payment of the option price (in the case of the share option plan) or by payroll deduction (in the case of the share purchase plan). Employees who held options under the former plan are able to exercise their option to purchase or right to subscribe for shares on the date the share price is determined.

To March 31, 1976, options for a total of 120,000 shares have been granted to four senior officers. Three key employees and three senior officers have been granted the opportunity to purchase a total of 60,000 shares. The option and purchase price of the shares ranges from \$0.315 to \$0.36 per share. The company has reserved 200,000 unissued shares under these plans.

5. Contract revenue

Effective July 15, 1975, the company contracted with the Government of Canada under the Program for the Advancement of Industrial Technology (PAIT) to undertake a specific project for the design and development of a new, deep towing system. This grant arose as a result of a Canadian/West German technical exchange agreement under which the Canadian and West German governments agreed to a joint sharing of the development costs incurred by the company on this project. The company has a contract with a West German company to develop and deliver the resultant deep towing system in December, 1976, of which \$415,000 is reflected in 1976 contract revenues, and a condition of receiving this contract was that the Canadian government would participate by contributing towards the relevant development costs. The Government has agreed to contribute

50% of defined expenditures incurred by the company on this project to a maximum of \$250,375, with the expectation that all development efforts on this project will have been completed by December 15, 1976. Up to March 31, 1976, the company has rendered billings of \$141,735 under the grant (of which \$67,175 is unpaid and included in accounts receivable) being the Canadian Government's share of this project's development costs incurred by the company to that date.

6. Commitment

At March 31, 1976, the company had a commitment under a premises lease to pay rent at an annual rate of approximately \$30,000 up to November 30, 1979.

7. Contingent liabilities for Government of Canada grants

From 1972 to 1975, the company received a grant under the Defence Industries Productivity (DIP) program in the amount of \$602,500 (including \$76,255 for fixed assets) for the development of towing systems. All or a portion of the grant is repayable out of future sales arising from the developed technology, or with government approval the funds may be reinvested in future development projects. To date, no provision has had to be made in the accounts for the possible repayment of this grant.

From 1973 to 1975, the company also received a grant in the amount of \$56,100 under the Program for the Advancement of Industrial Technology (PAIT) for the design of a towing system. Of this amount, \$18,700 represents a loan which is repayable on a royalty basis from any future sales of the fully developed system. As no sales of the system have been made to date and as future sales of the system are uncertain, no portion of the grant has become repayable.

8. Losses carried forward for income tax purposes

The company has losses totalling \$589,700 which can be carried forward for income tax purposes to be applied against future income of the company as follows:

To March 31, 1977	—	\$138,300
1978	—	71,900
1979	—	248,600
1980	—	130,900
		<u>\$589,700</u>

In addition, the company has unclaimed capital cost allowances in excess of depreciation charged in the accounts of approximately \$299,300.

9. Statutory information

In accordance with Section 122.2 of the Canada Corporations Act, it is reported that during the year there were seven directors who received \$1,000 as directors and seven officers who received \$149,109 as officers. During the year, four directors were also officers.

THE FATHOM STORY: origins and achievements

From remarkably humble roots, Fathom Oceanology has become a respected supplier of technological hardware with a wide range of international clients. It has taken eight years. Although previous achievements have included such non-nautical equipment as space satellite handling gear, the major sales volume lies in a three-part ocean towing system similar to the one the company first made in 1970.

The towed unit is called the fish, which houses electronic detection equipment. Along the tow-line, which links the fish to the vessel pulling it, are Fathom's patented fairings: small fins which keep the line from wandering. Fathom's third part in the system is a launch and recovery unit mounted onto the towing vessel.

There have been many kinds of underwater towing systems. Canada's first was the System 504, developed by the Royal Canadian Navy and Canadian Vickers Limited of Montreal. In 1962, the Canadian government began work on a new improved version, the System 505. An engineering consulting firm, Hale & Associates, was asked to work on the fish and design the electro-hydraulic controls of the launch and recovery equipment.

The interest generated by this project suggested there would be a market for lightweight sonar gear. All naval defence vessels had a need for it, but the bulky launch and recovery apparatus (usually a heavy crane) would fit only the larger ships, so only one vessel in 10 could be equipped. The Royal Swedish Navy was interested in developing a lighter system. This encouraged the principals of Hale & Associates to begin manufacturing. Fathom Oceanology was incorporated, and Hale & Associates became its first subsidiary.

Fathom designed its fish with no internal braces. This reduced distortion of the acoustic signal and allowed the electronics to yield more accurate readings. Keeping the surface smooth and stiff cut back on the noise of the fish cutting through water.

Fathom's exclusive fairing design reduced drag from the cable by as much as 90 percent. More important, it allowed the fish to go deeper at a much higher speed. At nine knots five hundred feet of faired cable could sink to 425 feet. Bare cable at the same speed would drop no deeper than 125 feet.

Most earlier fairings had been made from steel. They were necessarily curved to fit the winch; this made them difficult to work with. Fathom developed a polyurethane/ABS. fairing and patented it. As the registered name, Flexnose®, suggests, it's flexible to *bend* around a pulley. In the water it allows the towed body to reach greater depths at higher speeds than any other design.

The launch and recovery system swings the fish in and out of the water. Whereas previous methods called for four or five handlers, this is a one-man operation. Tension is stabilized through a hydraulic gas system which prevents the cable from snapping in a storm.

The first system completed by Fathom was for oil exploration in the Gulf of Mexico. A 1,000-pound fish was towed at 500 feet at speeds of six to eight knots. The system weighed half as much as others then in use. The simplified design reduced both manpower and maintenance. The number of hours it has been in operation to date has almost certainly established a record for underwater exploration.

Though the early results were encouraging it was not until Fathom completed its order for the Royal Swedish Navy that it began to attract important international attention. Unlike Texaco's relatively small oil exploration fish, which could move at eight to nine knots, the Swedes required a 2,500-pound fish capable of effective towing at no less than 30 knots. The system was delivered in July, 1972, and put through rigorous testing. It exceeded all expectations. But after the official tests the vessel was caught in a week of heavy storms off the west coast of Sweden. The new equipment was kept running, and Fathom's reputation grew considerably. Navies which had hitherto been reluctant to hear proposals began making enquiries. Soon, Fathom was engaged in work for the U.S. Navy, the government of Brazil, the Bedford Institute of Oceanography, and new customers in oil exploration.

But the development costs were enormous. Skilled designers and engineers were essential and the payroll became an onerous burden. And since Fathom's markets were scattered across the globe, marketing costs were a major item. A pattern of loss set in. By 1972, the Company was in financial difficulty. It was saved by the federal government's agreeing to share development costs for the Fathom towing systems. The federal government provided a DIP (Defence Industry Productivity program) grant, and in 1974, the federal government's Federal Business Development Bank purchased 297,000 Fathom shares. The government of Ontario provided a 10-year capital loan of \$100,000 and advanced a revolving line of credit to finance export orders.

In 1975, the turnaround began. Revenue accelerated sufficiently to allow the company to continue with reduced government aid, and finally with no assistance at all.

The future for Fathom appears considerably brighter than its past. Company projects now range from feasibility studies on submarine antennae to the construction of sonar domes. These tank-shaped structures are attached to the hull, usually of a naval vessel. The domes are acoustically transparent and filled with electrical gear which detects sound in the

water. Fathom is also building equipment listening device called a towed line array several thousand feet long and three inches thick. The tube is filled with oil and contains hydrophones over its length.

Though much of Fathom's work to date is to defence, its greatest potential is seen in other directions. The Fathom expertise which has led to work in underwater listening has led to work in other directions. The Physics Lab of Johns Hopkins University has developed a thermistor chain. This is a faired cable which the fairings include small and sensitive thermistors to give temperature readings at intervals along the cable's length. The readings are signalled back to a control room and allow oceanologists to plot temperature in the sea with greater accuracy than ever.

The strongest growth in underwater exploration possibly come from mineral exploration. There is world-wide interest in manganese nodules, small pebbles which somewhat resemble button cells and contain copper, nickel, and large amounts of manganese which is important in steel. Manganese nodules lie in beds on the seabed and are found by trolling a TV camera along the seabed. Existing equipment, it has been hard to move faster than one knot. But Fathom believe their faired cable technology can move at seven to eight knots.

The firm's first involvement in the mining of the seabed through a federal government grant under the program for Advancement of Industrial Technology. After a major hardware contract from Germany, Fathom has asked to develop an extra-deep towing system. As interest grows, the company may well be involved in other areas of mining beneath the seabed.

- 1 Scale models are made to prove out design of deep-sea towing system.
- 2 Part of the ultra deep-sea towing system for deep-sea exploration being prepared for test at the Fathom facility.
- 3 The Honorable J. G. H. Halstead, (right) Canadian Minister of International Trade, the Federal Republic of West Germany visiting "Interocean 76" in Düsseldorf.
- 4 Typical control console for deep-sea towing system.
- 5 Sonar domes for export. Fathom is producing about one per month.
- 6 Thermistor chain and handling gear installed on a vessel.
- 7 Fathom's present range of Flexnose® fairings in one and one-half inch cable sizes.

NEW PRODUCTS: pipestream fairing

As a result of its work in deep towing, Fathom has become increasingly involved in other aspects of deep sea mining. This has led to product development beyond the basic towing system. The most advanced new development to date is the Fathom Pipestream fairing.

Pipestream has been designed to fulfil a need for stabilizing large diameter (typically 12 to 24-inch) pipe, which, in offshore mining is towed vertically below the ship. Although mining speeds are relatively low at one to three knots, the immense length of the towed pipe (15,000 to 20,000 feet) combined with varying speeds of current, create a severe vibration through a phenomenon known as vortex shedding. In tests this vibration has posed problems in keeping the pipe firmly attached to the ship. It can easily have the effect of a long powerful "tail" literally "wagging the dog."

Fathom has developed a large fairing ranging in length from 5 to 8 feet. When attached to a pipeline in adjacent sections down the pipe, it eliminates vibration and reduces drag by about 90 percent.

The Pipestream concept is not limited to ocean mining. It is equally suitable for drill rig riser pipes subjected to currents and for small-bore exploration drilling. In this latter case efficient movement from site to site can be achieved by towing the faired drill casing and bottom anchor rather than taking time in disassembly and reassemble at each site.

It is expected that the Fathom Pipestream fairing will prove similarly valuable for laying fuel pipelines across waterways where the current often creates problems for installers, and at times can lead to disasters where installed cranes and bulldozers are dragged into the water by the enormous forces acting on the pipe as attempts are made to place it in position.

In both its vertical and horizontal applications, the need for Pipestream fairings will almost universally involve lengths of several miles, creating a very encouraging potential for our product.

A single twelve inch pipestream fairing.

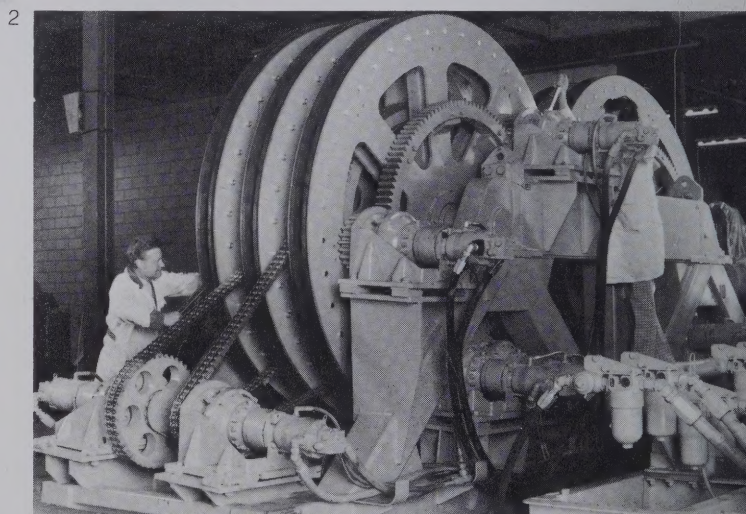
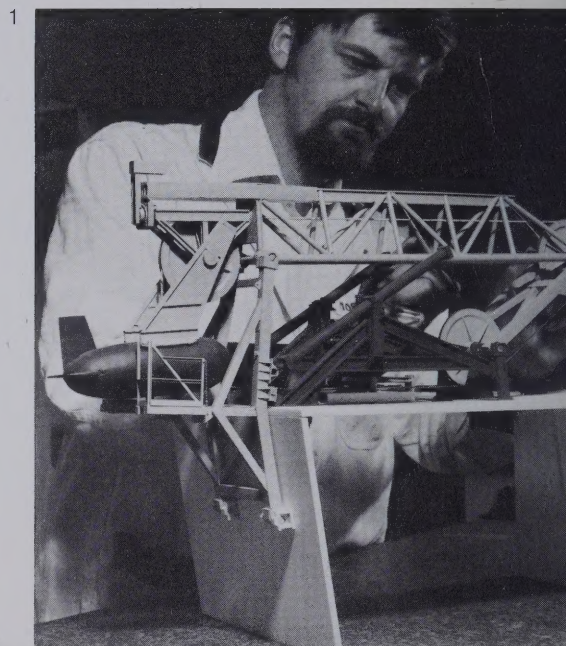


water. Fathom is also building equipment for another listening device called a towed line array: a plastic tube, several thousand feet long and three to four inches thick. The tube is filled with oil and carries an "array" of hydrophones over its length.

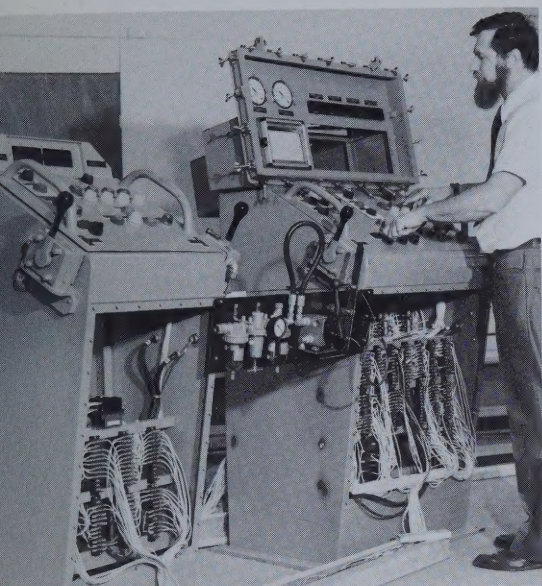
Though much of Fathom's work to date has been related to defence, its greatest potential is seen in other directions. The Fathom expertise which began with underwater listening has led to work with the Applied Physics Lab of Johns Hopkins University in producing a thermistor chain. This is a faired cable towing system in which the fairings include small and sensitive thermistors to give temperature readings at various intervals along the cable's length. The temperature readings are signalled back to a control centre on deck and allow oceanologists to plot temperature profiles of the sea with greater accuracy than ever before.

The strongest growth in underwater equipment will possibly come from mineral exploration. Already there is world-wide interest in manganese nodules, small pebbles which somewhat resemble burnt peanuts. They contain copper, nickel, and large amounts of manganese which is important in steel production. Manganese nodules lie in beds on the ocean floor, and are found by trolling a TV camera along the bottom. With existing equipment, it has been hard to get the camera moving faster than one knot. But Fathom engineers believe their faired cable technology could achieve seven to eight knots.

The firm's first involvement in the mineral field came through a federal government grant under the Program for Advancement of Industrial Technology followed by a major hardware contract from Germany. Fathom was asked to develop an extra-deep towing device. As interest grows, the company may well find itself involved in other areas of mining beneath the sea.



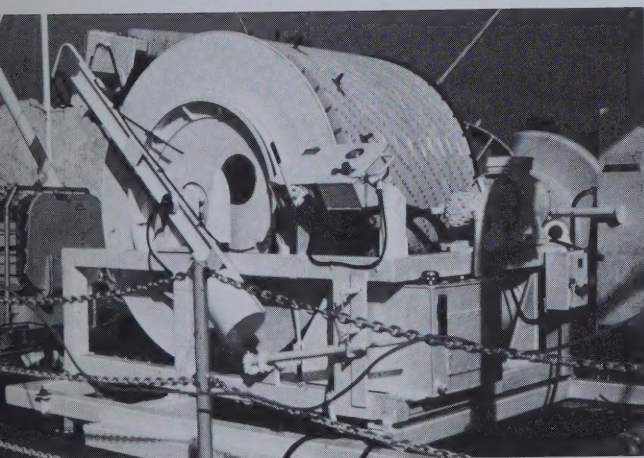
- 1 Scale models are made to prove out design geometry.
- 2 Part of the ultra deep-sea towing system for manganese nodule exploration being prepared for test at the Fathom plant.
- 3 The Honorable J. G. H. Halstead, (right) Canadian Ambassador to the Federal Republic of West Germany visiting the Fathom booth at "Interocean 76" in Düsseldorf.
- 4 Typical control console for deep-sea towing system.
- 5 Sonar domes for export. Fathom is producing these at the rate of about one per month.
- 6 Thermistor chain and handling gear installed on a U.S. research vessel.
- 7 Fathom's present range of Flexnose® fairings spans three eighths to one and one-half inch cable sizes.



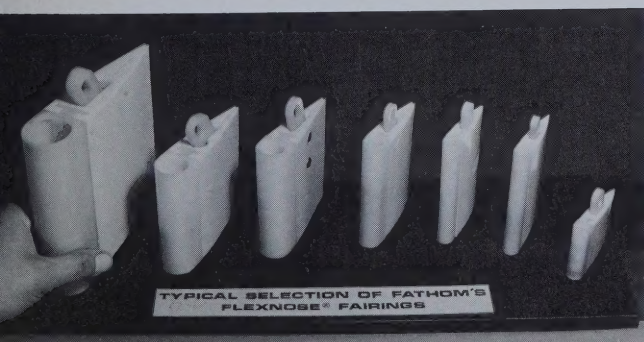
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